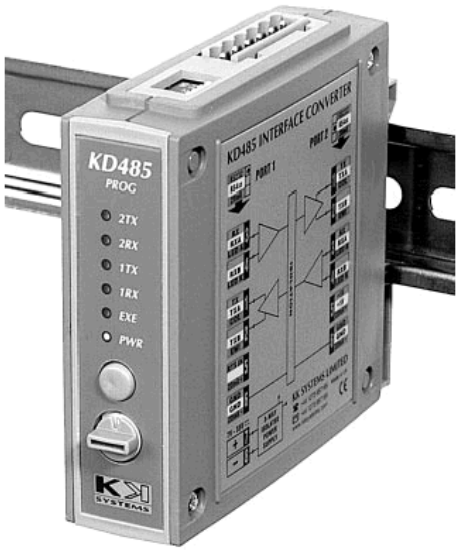
FIRE AND SECURITY

AUTRO SAFE

Self Verify®

Interactive Fire Alarm System



Installation & Commissioning Handbook, User Guide

Modbus Interface Module BSL-330

AutroCom Protocol Version 1.1

AUTRONICA

Protecting environment, life and property...

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1. Introduction

1.1 About the Handbook

This handbook is intended to provide all necessary information for the installation and commissioning of the *Modbus Interface Module BSL-330*, hereby called the **BSL-330 module**.

The commissioning section gives guidelines on how to use the specific AutroSafe configuration data and mapping registers to perform the register mapping and configuration / programming of various external PLC equipment (Programmable Logic Controllers).

1.2 The Reader

The handbook is intended to be used by trained service and technical personnel who are responsible for the installation and commissioning of external PLC equipment used with the AutroSafe Interactive Fire Alarm System.

We assume that the reader has the following basic knowledge.

- AutroSafe functionality
- AutroSafe Configuration Data (output from the AutroSafe Configuration Tool, configuration files)

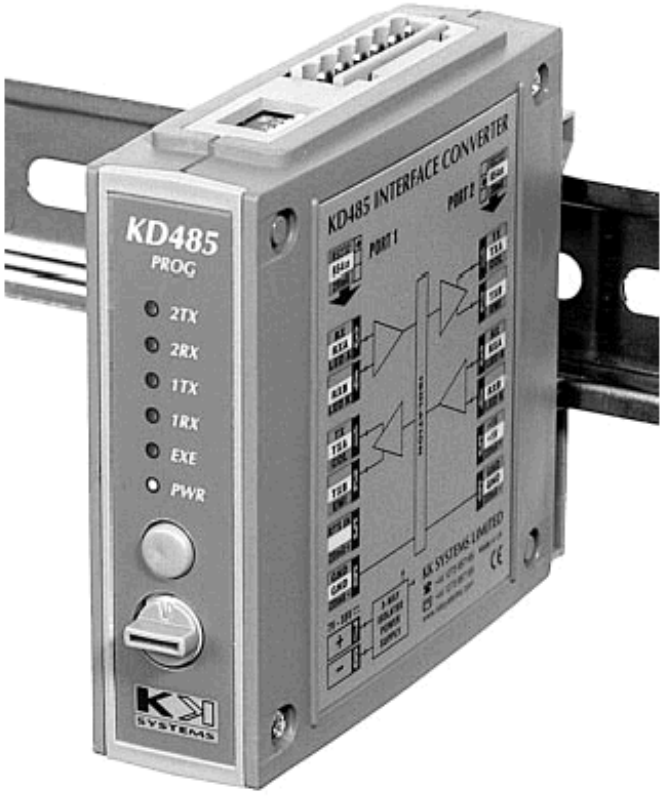
1.3 Terms and Abbreviations

The handbook deals with AutroSafe-related terms and abbreviations.

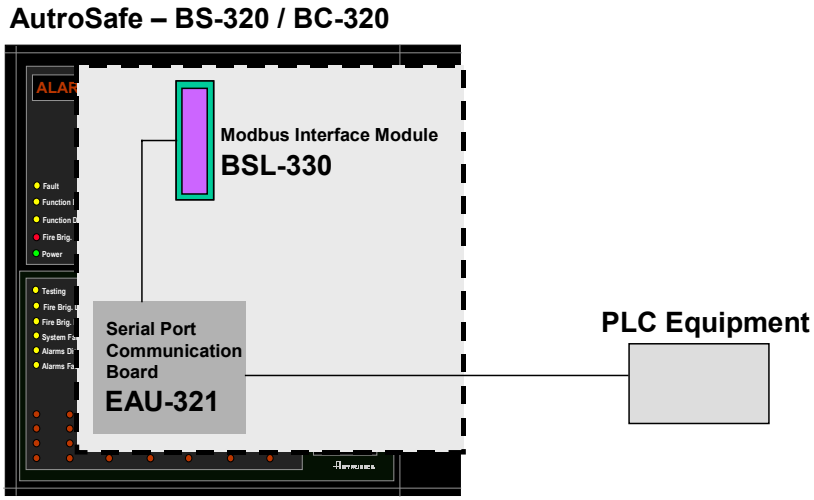
For further information on definitions, refer to the System Specification and Operator's Handbook for the AutroSafe Interactive Fire Alarm System. Some of these terms and abbreviations are also listed in Appendix in this handbook.

1.4 The Product

The BSL-330 module is an RS-232/422/485 interface module used to interface various PLC equipment (Programmable Logic Controllers) to the AutroSafe Interactive Fire Alarm System. Refer to detailed description and specification in section 2 in this handbook.

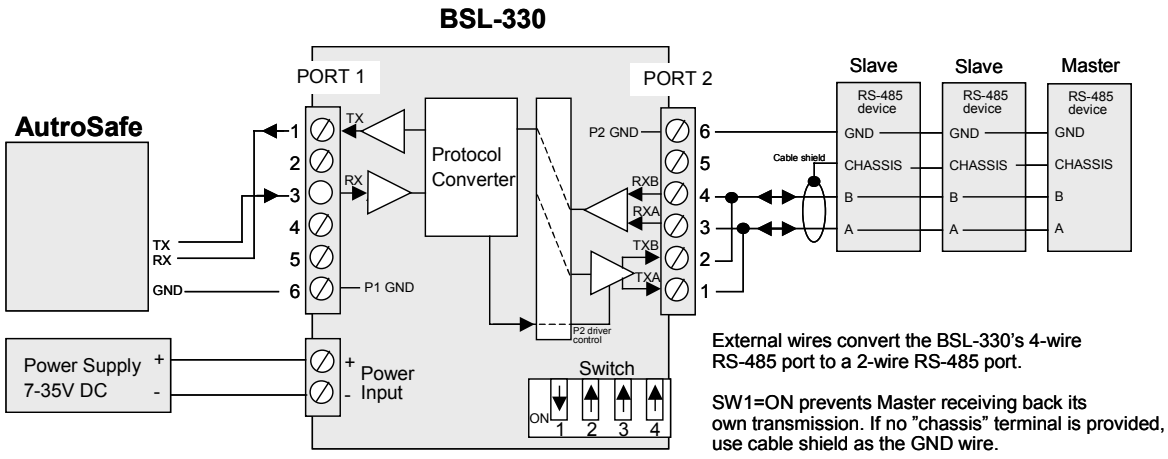


1.5 Overview



1.6 Typical Application

The drawing below shows a typical application of the BSL-330 module.



External wires convert the BSL-330's 4-wire RS-485 port to a 2-wire RS-485 port.

SW1=ON prevents Master receiving back its own transmission. If no "chassis" terminal is provided, use cable shield as the GND wire.

1.7 Reference Documentation

In addition to this handbook, Autronica Fire and Security offers the following documentation:

Handbook	Item Number
System Specification	P-ASAFE/XE
Installation Handbook, Fire Alarm Control Panel (BS-310/320) / Controller (BC-320)	P-ASAFE-FA/DE
Installation Handbook, Operator Panel (BS-330)	P-ASAFE-OP/DE
Installation Handbook, Repeater Panel (BU-320) / Information Panel (BV-320)	P-ASAFE-RI/DE
Installation Handbook, Battery Cabinet (SY-310)	P-ASAFE-BC/DE
Commissioning Handbook	P-ASAFE/EE
Operator's Handbook, Fire Alarm Control Panel (BS-310/320) / Operator Panel (BS-330)	P-ASAFE-FO/FE
Operator's Handbook, Repeater Panel (BU-320)	P-ASAFE-FB/FE
Operator's Handbook, Information Panel (BV-320)	P-ASAFE-IN/FE
Shortform User Guide	P-ASAFE-SH/LE
Shortform Configuration Guide (for the AutroSafe Demo Board)	P-ASAFE-SH/VE
Wall Chart	P-ASAFE-WE/LX
Wall Chart	P-ASAFE-CH/LX
Menu Structure	P-ASAFE/MX
User Guide, Loop Diagnostic Tool, AS-2000	P-ASAFE-AS/FE
User Guide, Loop Simulator Tool	P-ASAFE-LS/FE
User Guide, Loop Calculator Tool	P-ASAFE-LC/FE
User Guide, Merge Tool	P-ASAFE-MT/FE
User Guide, Power Calculator Sheet	P-ASAFE-PC/FE

2. The Modbus Interface Module

2.1 Description

The BSL-330 module is an RS-232/422/485 interface module used to interface various PLC equipment (Programmable Logic Controllers) to the AutroSafe Interactive Fire Alarm System. The module is both a physical and a logic protocol converter. At the physical connection level, it transforms an RS232 connection to an RS485 or RS422 connection. This is convenient as this type of connection is safer in noisy environments.

The module is connected to the AutroSafe via the AutroCom protocol. It communicates with both protocols by means of the conversion software.

A master Modbus device polls the BSL-330 module for reading its registers. It expects a response within a defined time period. Communication can be over various serial mediums. The one used here is the MODBUS RTU protocol over an RS485 link. The communication is set at 9600 baud, 8 data bits, 1 stop bits and no parity.

The BSL-330 module allows:

- detector statuses on the AutroSafe to be made available to a Modbus PLC
- users to send basic commands to the AutroSafe from a Modbus PLC

The Modbus PLC acts as “master” to the BSL-330, and the AutroSafe as “slave” to the BSL-330. The AutroSafe appears to the Modbus PLC as a Modbus slave.

For information on *Communication,* refer to section 5.3.1.

The BSL-330 module has the following features:

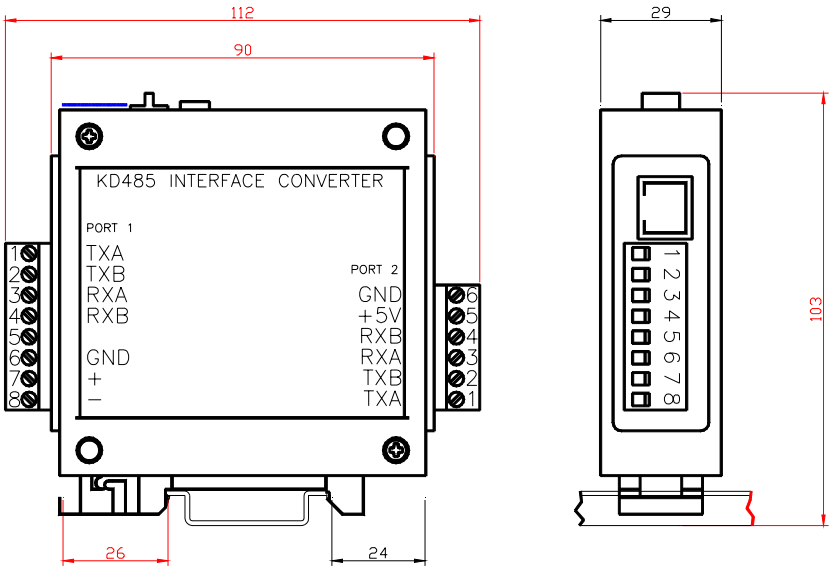
- DIN-rail enclosure with removable screw terminals; fits 35mm symmetric rails
- DC power input in the range +7V to +35V; uses a high efficiency switching power supply
- Two serial ports: Port 1 and Port 2; isolated from each other and from the power supply
- Port 1 is RS-232; Port 2 is RS-422/485
- Controlled slew rate drivers on RS-422/485 ports - no terminators needed for cables shorter than 300m
- Internal pull-up/pull-down resistors on RS-422/485 ports ensure that RS485 bus floats to a valid state when not driven

2.2 Specifications

Ports	Two asynchronous ports, TX & RX signals only. XON/XOFF selectable.
Interface Options	port 1 is RS232; port 2 is RS422/485.
RS-232	Receiver threshold + 1.5V typ. Receiver Rin 5kΩ typ. TX o/p ±8V typ (3k load).
RS-422/485	Receiver threshold 200mV typ (differential). Receiver Rin 12kΩ min. TX o/p 0 to + 5V (no DC load); + 2 to + 3V (120Ω ohm load).
Power supply	+ 7V to + 35V DC. + 12V DC Input power approx. constant at 1-2 watts (startup current 300-600mA) depending on model. At startup, the supply voltage must reach 7V in <1 sec.
Isolation	64V PK, tested at >1000V AC RMS, 1 second.
Environmental	Operating temperature 0 to +50C. Storage temperature -25C to + 70C. Relative humidity (operating and storage) 0 to 90%, non-condensing.
Ventilation	Rail-mounted KD485 must have a 50mm gap above and below.
EMC compliance	Emissions EN50081-2 (94), immunity EN50082-2 (95).
Dimensions	29mm (W) x 112mm (H) x 103mm (L) approximately in rail-mounted position, including screw terminals.

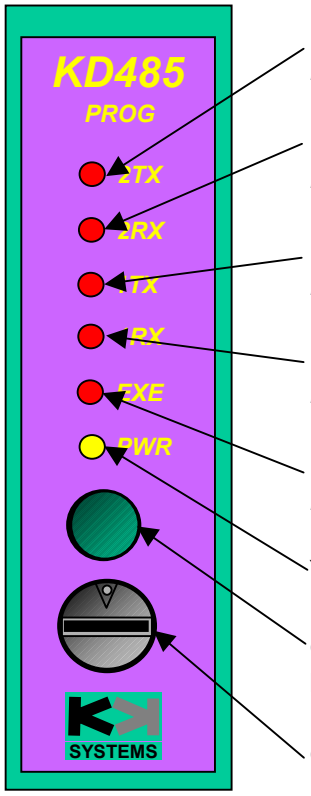
2.3 Dimensions

The drawing below shows the dimensions of the BSL-330 module.



2.4 Indicators & Buttons on the Front Panel

The BSL-330 module has the following indicators and buttons:



Red LED - Send (TX) Port 2 (to external PLC equipment).
Blinking light (2 seconds intervals) indicates that signals are being sent.

Red LED - Receive (RX) Port 2 (to external PLC equipment).
Blinking light (2 seconds intervals) indicates that signals are being received.

Red LED - Send (TX) Port 1 (to EAU-321 – AutroSafe).
Blinking light (2 seconds intervals) indicates that signals are being sent.

Red LED - Receive (RX) Port 1 (to EAU-321 – AutroSafe).
Blinking light (2 seconds intervals) indicates that signals are being received.

Red LED – Executive Mode (when setting paramters)
Blinking light (1 second intervals) when green button has been pressed.

Yellow LED – *Steady light indicates Power ON.*

Green Executive Mode button. Used to enter Executive Mode (when setting parameters).

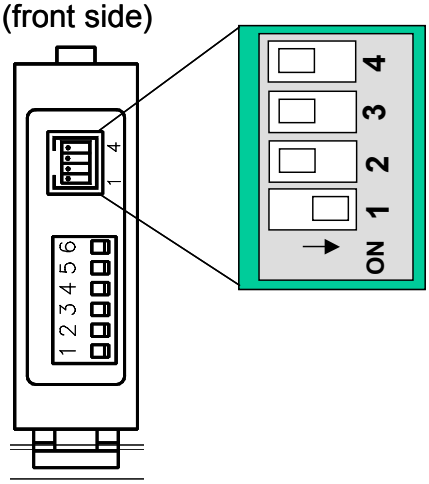
Grey rotary switch (default factory settings - 0).

2.5 Dip-switches – Overview

For information on *Dip-switch Settings*, refer to 3.2.

Top View of BS-330 Module

(front side)



(rear side)

3. Preparing for Commissioning

3.1 Introduction

Normally, the necessary preparations for commissioning are done by Autronica Fire and Security. These preparations are described in this section.

The necessary preparations, include the following:

- The dip-switches must be verified (factory set)
- The BSL-330 module must be connected to a 24V DC power source
- The BSL-330 module must be connected to a computer's serial port
- The BSL-330 module must be set to Executive Mode
- The required parameters must be set

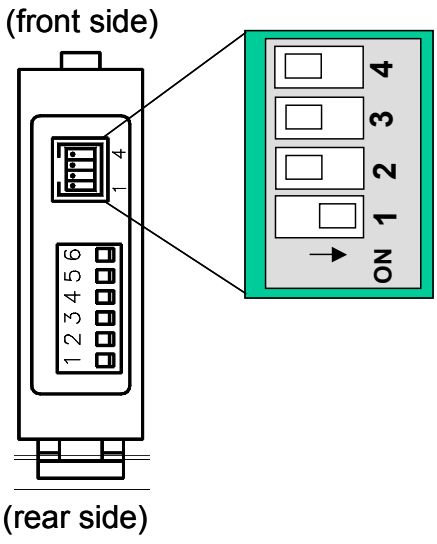
3.2 Dip-switch Settings

The illustration below shows the dip-switch settings on the BSL-330 module.

Switch 1 = ON for RS-485 / 2-wire
Switch 1 = OFF for RS-422 / 4-wire
Switch 2 = OFF
Switch 3 = OFF
Switch 4 is not used.

The rotary switch on the front panel must be set to 0.

Top View of BS-330 Module

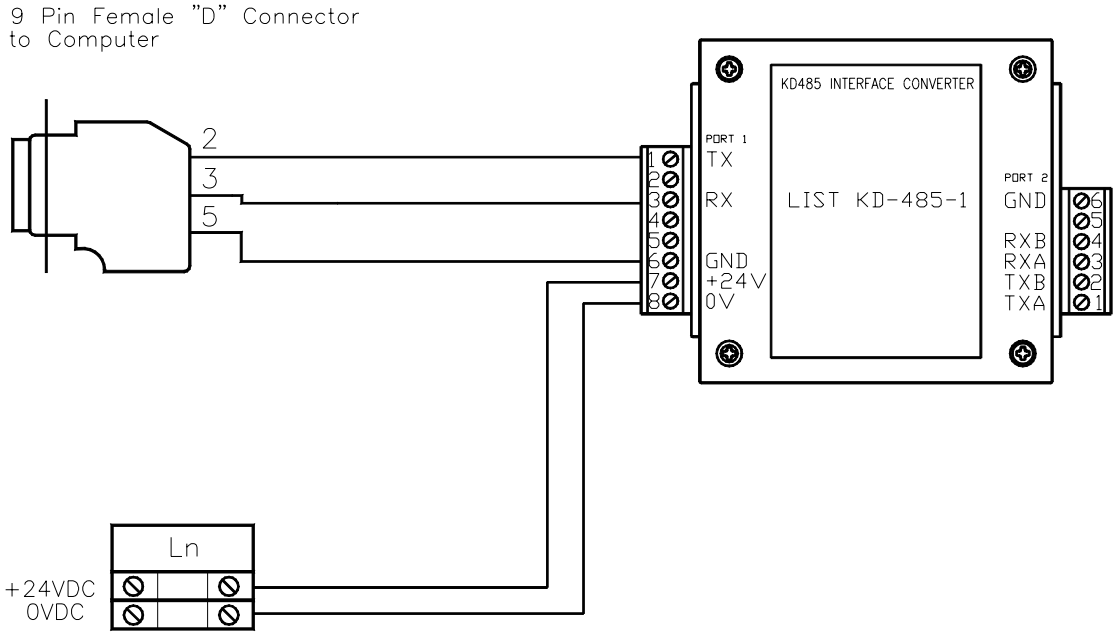


3.3 Cable Connections

Before entering Executive Mode and setting the required parameters, the necessary cabling must be done.

- Consult the cable drawing below.

- Connect the cable from the 24V DC power source to the connector (Port 1) on the BSL-330 module.
- Connect the cable from the computer"s serial port to the connector (Port 1) on the BSL-330 module.

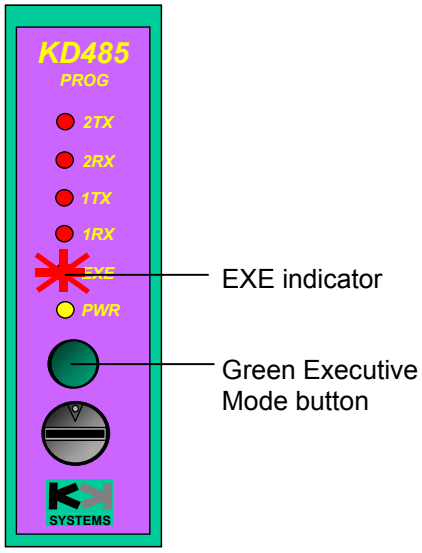


3.4 Entering Executive Mode

The BSL-330 module must be electronically configured before it can be used. Configuration must be done via Port 1, which has to be set to *Executive Mode*.

- To enter Executive Mode, press and hold down the green *Executive Mode button* on the front panel approximately 5 seconds until the EXE indicator starts blinking, then release it.

  A few seconds later (approximately 3-4 seconds), the red EXE indicator will blink rapidly (1second ON / 1 second OFF), and you can start the configuration program.

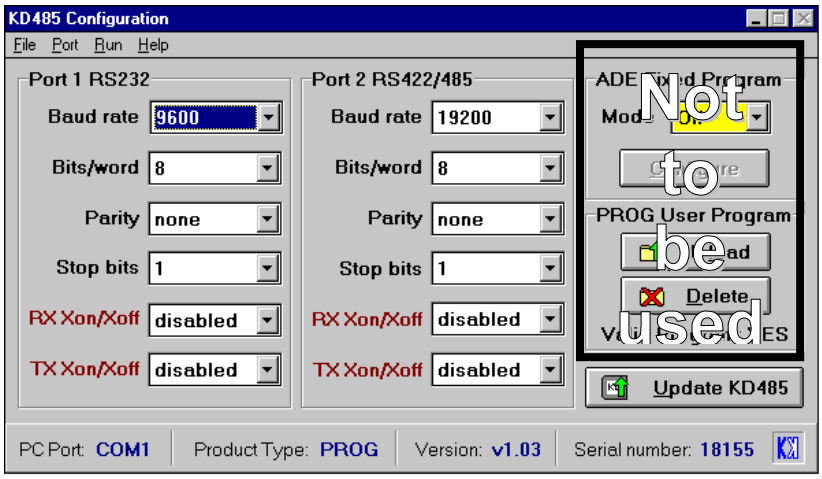


3.5 Setting Parameters / Configuration Program

The parameter settings for Port 1 *(AutroSafe)* and Port 2 *(PLC)* are done by means of the KD485 Configuration Program, which is delivered with the BSL-330 module.

- Make sure that the BSL-330 module is in Executive Mode. The EXE indicator should be blinking rapidly. If not, communication is not established, and you must repeat the procedure described in the previous section (*Entering Executive Mode)*.

- Insert the floppy disc into your harddisk drive.
- Dobbelclick on the installation icon, and the Configuration Menu will appear on screen.



- Set the baud rate for Port 1 *(AutroSafe)* to 9 600 baud, 8 bits, 1 stopbit, even parity (which is the default setup of AutroSafe).

  Note that these parameters can be changed for AutroSafe by means of the AutroSafe Configuration Tool.

- Choose RX Xon/Xoff *disabled* (the Xon/Xoff characters to control data being received on Port 1)
- Choose TX Xon/Xoff *disabled* (the Xon/Xoff characters received by BSL-330 control transmitted data on Port 1).

- Set the appropriate parameters for Port 2 (external PLC equipment) according to the PLC requirement.

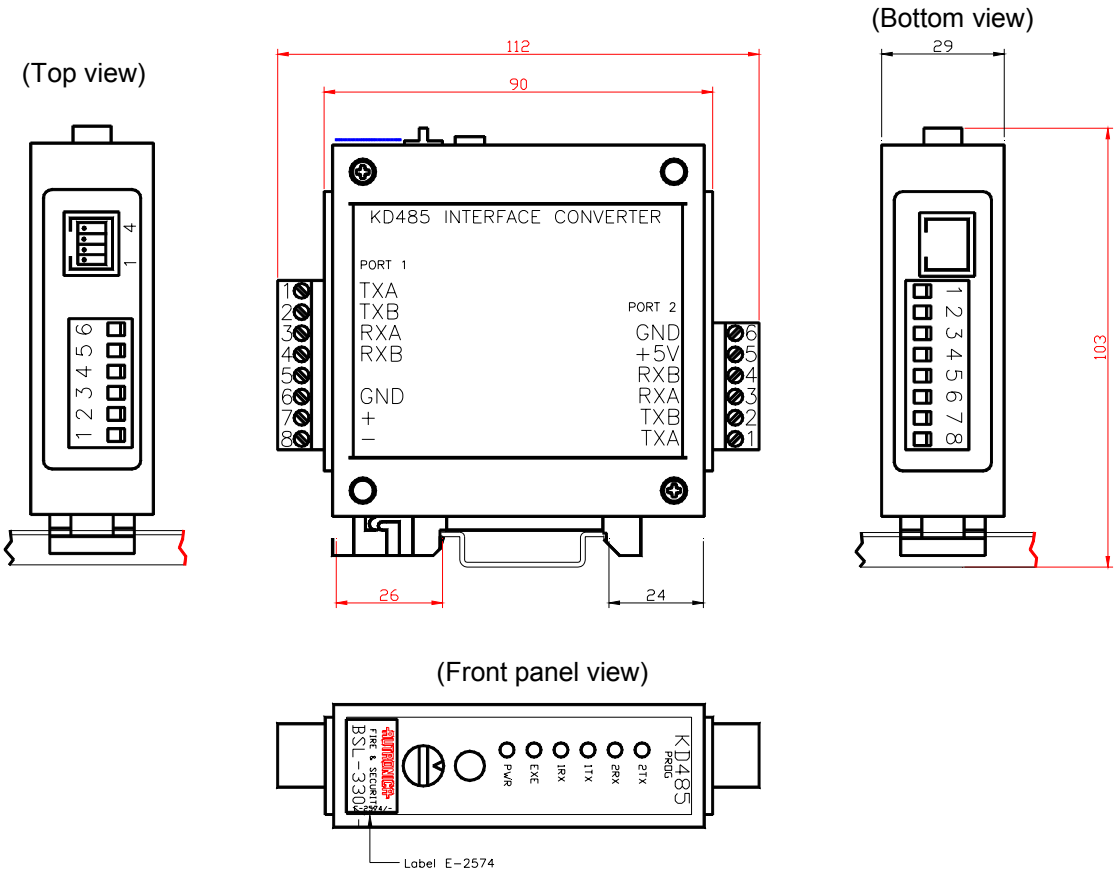
- Click on the highlighted button marked *Update KD485* and the message *Writing new KD485 Configuration* will appear on screen.

When the message disappears, and the *Update KD485* button no longer is highlighted, all parameters have been set and the configuration is completed.

4. Installation

4.1 Overview

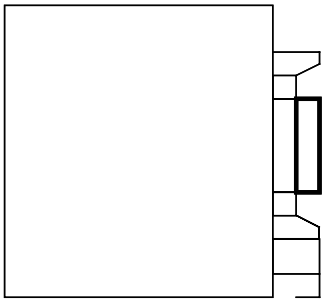
The drawing below gives an overview of the screw terminals.



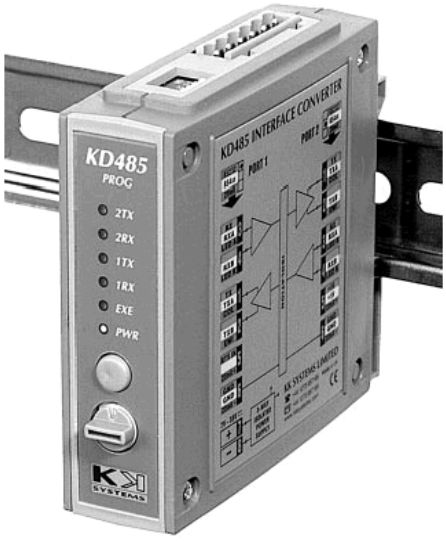
4.2 Mounting the BSL-330 Module

For ventilation purposes, make sure that there is a free space of minimum 50 mm above and below the BSL-330 module after it has been rail-mounted inside the cabinet.

- Simply, snap the BSL-330 module onto the DIN rail inside the AutroSafe Fire Alarm Control Panel BS-320.



DIN rail clip



NOTE:
If the BSL-330 module is to be *removed* from the rail, gently lift the front end upwards. If necessary, use a flat screwdriver to open up the DIN rail clip. Note that very little force is required.

4.3 Connecting the RS-232 Serial Interface Cable

The drawing below gives an overview of the cable connections.

As shown on the drawing, *Port 1* is used for the cable connection from AutroSafe, while *Port 2* is used for the connection to the external PLC equipment.

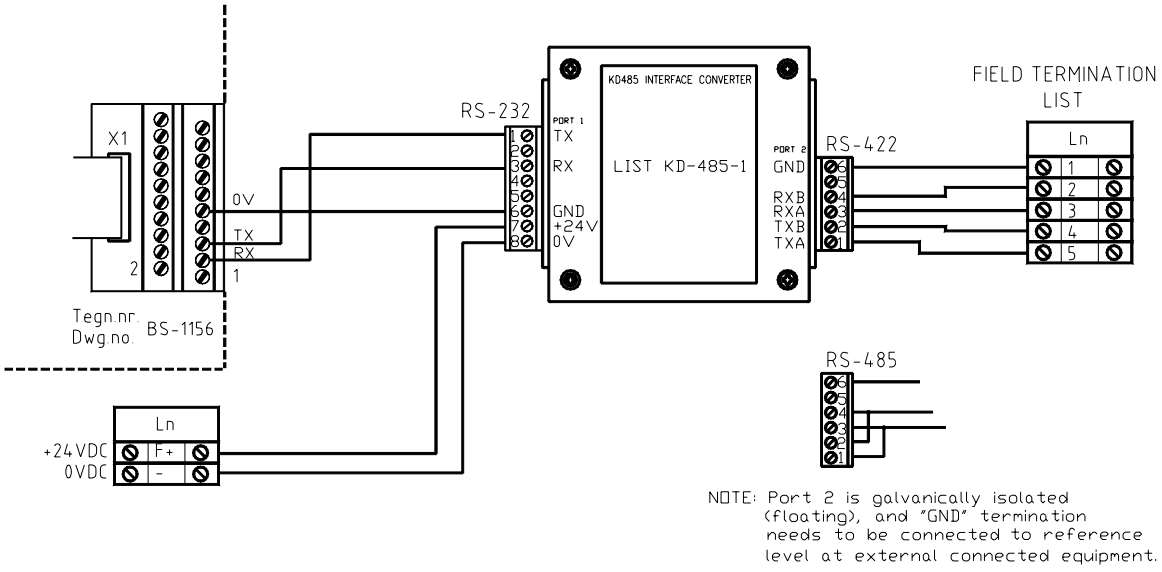
- Consult the cable overview drawing below.
- Connect the cable from the Serial Port Interface Board EAU-321 (inside the AutroSafe BS-320) to the connector (Port 1) on the BSL-330 module.

If the BSL-330 module is placed outside the AutroSafe BS-320 Fire Alarm Control Panel, the maximum distance from the EAU-321 board to the BSL-330 module is 10 meters.

- Continue following the step-by-step procedure described in the next section *Commissioning.*

4.4 Overview - Cable Connections

The drawing below gives an overview of the required cable connections.



5. Commissioning

5.1 Overview

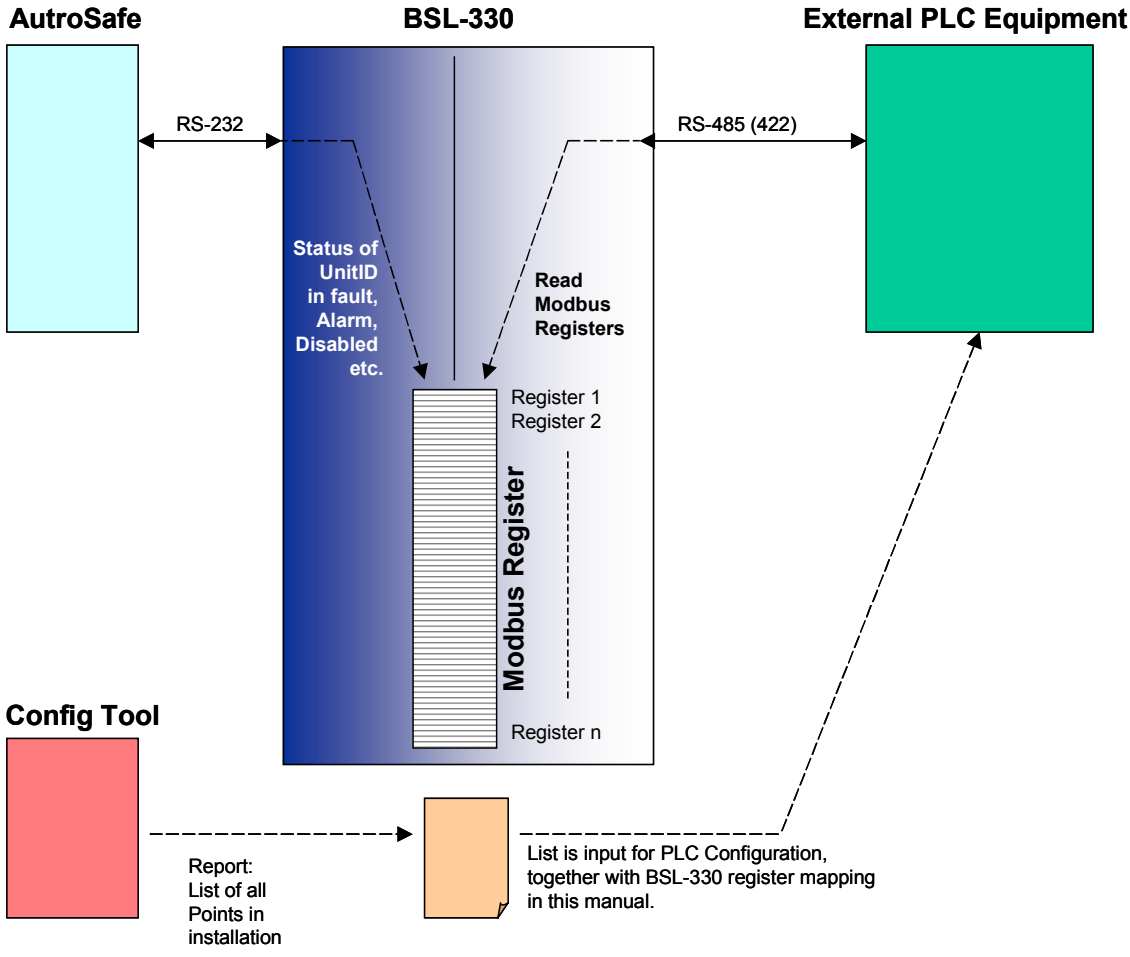
The site-specific AutroSafe configuration data and the BSL-330 register mapping (Modbus register, see *Modbus Register Mapping*) are used as input for the configuration of the external PLC equipment, which is to be considered as the *master modbus* device.

The BSL-330 module reads all status messages from AutroSafe on a protocol called AutroCom, and keeps the accumulated results in a list of registers internally.

The PLC polls the BSL-330 module for reading its registers. It expects a response within a defined time period. Communications can be over various serial mediums. The one used here is the MODBUS RTU protocol over an RS485 link.

The PLC takes action on some (or all) of the status messages from AutroSafe.

The illustration below gives an overview of the data communication.



5.2 Step-by-step Procedure

The commissioning of the BSL-330 module includes the following steps:

Step		✔
1	Complete the site-specific AutroSafe configuation by means of the AutroSafe Configuration Tool, including: - List of detectors / alarm points - Cause / effect - AutroCOM port settings (refer to *Setting Parameters / Configuration Program)* - List of panels - List of other devices	
2	Download the Configuration files to AutroSafe.	
3	Install and connect the BSL-330 module as described in the previous section.	
4	Power up the BSL-330 module - connect the cable from the 24V DC power source to the connector (Port 1) on the BSL-330 module (refer to the cable connections overview on the previous page).	
5	Verify that the BSL-330 module is properly connected to AutroSafe and that connection is established. The 1RX and 1TX indicators should blink at least every 8 seconds.	
6	Complete the site-specific PLC configuration, including: - Cause / effect - Modbus Register Map versus AutroSafe Unit IO's (from AutroSafe configuration file "Installation \ UnitName.txt") - BSL-330 module port 2 settings (refer to *Setting Parameters / Configuration Program)*	
7	Do the necessary connections between the external PLC equipment and the connector (Port 2) on the BSL-330 module.	
8	Verify that the BSL-330 module is properly connected to the PLC and that connection is established. The 2RX and 2TX indicators should blink at least every 3 seconds.The exact interval will depend on the PLC's polling period.	
9	Verify all critical functions.	

5.3 How to Use the AutroSafe Data and Registers

5.3.1 Communication

The MODBUS and AUTROCOM communications are performed independently. This means that the MODBUS master's communication to the BSL-330 module does not lead to a corresponding message to the AutroSafe. The BSL-330 module continuously monitors the MODBUS port and responds using the data available on the BSL-330 module. The BSL-330 module monitors the AUTROCOM line independently of any MODBUS activity, and if there is a command to be sent, it does so, using flags.

As can be seen from the illustration on the previous page, AutroSafe status is written to the register file in BSL-330 by BSL-330 itself. This list of register is then at regular intervals read from the Modbus Master.

System Register 1 is to be read first, to show the actual state of the system. A content of 0x1 shows that BSL-330 is able to present correct information.

The Detector Information (Input Registers 48 to 4144) is then scanned to read point status.

Writing to the AutroSafe (via BSL-330) is made through the Command Register (Read/Write Holding Register 1), which may use Date & Time Register (Read/Write Holding Registers 2 & 3).

5.3.2 Information Available to the PLC

Information available to the PLC

Detector Status
- Alarm (or early warning)
- Pre-warning – in the case of gas detectors, Low gas
- Fault
- Disabled

AutroSafe Status
- Faults and Disablements in the system

Commands available to the Modbus PLC

- Silence the AutroSafe alarm bells / sirens.
- Reset the AutroSafe unit.
- Disable a detector
- Restore a detector
- Write to the AutroSafe clock

5.3.3 Interpreting and Handling Information in the List

Interpreting this list is the clue when setting up the external connection to BSL-330 module. The register definition is defined by the tables in the next section of this handbook (*Modbus Register Mapping)* . However, some of these registers are directly dependent on the actual AutroSafe configuration.

In AutroSafe, each detector is labeled by a *Unit Name* and a corresponding *Unit ID*. The Unit ID is the index in the register file.

The AutroSafe configuration data for the site installation must be available in a report, including the detector identification, (either by point no/loop no, the tag name, the serial no or similar) and the UnitID. The UnitID of the detector is the index in the list of registers.

A typical AutroSafe Configuration file includes the following information (from "UnitName.txt):

0x0001 L1-Heat
0x0002 L1-MCP
0x0003 L1-Multi
0x0004 L1-Opt

The detector "L1-Opt" is then found in register 50, MSB.
Note that the sequence of detectors may be non-contiguous, leaving some few SystemIDs unused.

5.3.4 AutroSafe Slave Address

The MODBUS Slave address of the BSL-330 module is set during the configuration of the BSL-330 module. It can not be changed on-line.

5.3.5 Fault Handling

At receipt of a fault from AutroSafe, the BSL-330 responds with an Acknowledge to this fault. AutroSafe in turn replies either with a "FAULT OK" (the fault was intermittent), or with "FAULT ACCEPTED". In the latter case, the BSL-330 asserts the fault flag for the related device in the register. This will reflect the fault condition of AutroSafe.

5.4 Modbus Register Mapping

This section deals with the MODBUS 3x and 4x series register map used by the AutroSafe. Addressing begins with 0. The counting of these registers is assumed to start from 1, though the MODBUS communications register value starts from 0. Care should be exercised to ensure that the communications address and the general address are not confused.

5.4.1 Register Allocation Summary

All the data in the BSL-330 module is related to the storing of AutoSafe Information in MODBUS registers. The structure, its MODBUS mapping and the AutroSafe information that is stored is summarized as follows:

KD485 structure element	MODBUS	AutroSafe Information Stored
slave_status	Input Register 1	Slave (KD485) Status Register
detector_status[]	Input Registers 48 to 4144	Detector information
command	Holding Register 1	Command Register
time	Holding Register 2	MS Time Register
time	Holding Register 3	LS Time Register

5.4.2 Slave Status Register (Input Register 1)

This register indicates the status of the Slave device itself, that is the BSL-330 module. The status is updated and available to the Master device even when the AutroSafe is unavailable.

Register Contents	Command	State
0x0000	System Down	Prior to receiving Logon Ack from AutroSafe
0x0001	System Functioning Normally	When logged on to AutroSafe, and receiving Ping Ack
0x0002	Communications Error to AutroSafe	After a Link Error is detected up to receipt of Logon Ack
0x0004	System Starting Up	At Logon, set when status is updated and AutroSafe is not yet started
0x200	Faults	Any fault in detector or system asserts this flag.
0x100	Disablements	Any Disablement related to detector or system asserts this flag.

5.4.3 Detector Information (Input Registers 48 to 4144)

Each AutroSafe input is mapped by the BSL-330 module to half a MODBUS Input Register (8 bits). That is, two detectors share the two bytes of the same MODBUS Input register, as follows:

Detector	MODBUS Input Register	
0	48	MSB
1	48	LSB
2	49	MSB
3	49	LSB
.....	.....	.....
8191	4144	MSB
8191	4144	LSB

The format of each of the input register data is as follows:

Bit	Meaning when set
bit 0	Alarm/High Gas Alarm
bit 1	Pre-Warning/Early Warning/Low Gas Alarm
bit 2	Fault
bit 3	Disabled
bit 4	Not used
bit 5	Not used
bit 6	Not used
bit 7	Not used

5.4.4 Command Register (Read/Write Holding Register 1)

This register is used to pass commands to AutroSafe. The commands available are as follows :

Register Contents	Command
0x1000	Silence Bell
0x2000	Reset
0x3000	Read System Time/Date 2)
0x4000	Write System Time/Date
0x8000 + detector number	Detector disable
0xc000 + detector number	Detector restore

Notes 1
Writing of time and date information must be done by two separate commands, the first to write to holding registers with the time and date information and then writing to the command register.

Notes 2
Read System Time is not yet implemented.

5.4.5 Date & Time Register (Read/Write Holding Registers 2 & 3)

These two registers simply store the Unix time to be transferred, that is, seconds since Jan 1 1970, 00:00.

Note that Holding Register 1 needs to be zero when writing to register 2 and 3.

Register 2 is the Most significant half of the 32 bit value.

6. Appendix

6.1 Terms and Abbreviations

Term / Abbreviation	Explanation
Activation	To bring a *component* into (one of) its active activation states (depending on type, a component may have several active activation states). Examples of activation are turning a fire extinguisher on and making a sounder to issue a EVACUATE or ALERT signal. Components may be activated and deactivated either on command or on alarm.
Alarm Zone	The geographical area throughout which Fire Alarm Devices give identical alarm signals present identical audible information in response to the same event. An alarm zone is activated by one or several Detection Zones. The alarm zone assigned to the detection zone in alarm is called the parent alarm zone. Fire Alarm Devices in a parent alarm zone will always give EVACUATE signal. To any (parent) alarm zone there may be defined a number of neighbour alarm zones. Fire Alarm Devices in neighbour alarm zones will give alert signal when its parent alarm zone gives EVACUATE signal.
AUTROLON	Autronica's Local Operating Network
BLC-Eq	Basic Loop Controller Equipment (equipment part for all Loop Units and I/O modules, i.e. Eq-part for Loop-Ctrl, Point-Ctrl, FPE-Ctrl etc.)
Component	An assembly of one or more modules, implementing a system function. The following components are defined in the AutroSafe Interactive Fire Alarm System (also see detailed description of *Components,* Chapter 1): • Points (fire detectors, manual call points) • Detection Zones • Fire Protection Equipment (fire extinguishers, ventilation controllers) • Fire Alarm Devices (sounders, information panel, visual indicator) • Fire Alarm Routing Equipment • Fault Warning Routing Equipment • Operator Panels
Condition	Meaning similar to «state», but used only in conjunction with the control and indication equipment. (EN54 standard).
Control and indicating equipment (c.i.e)	Equipment supplying power to, as well as accepting fault and alarm signals from detectors. A c.i.e. will indicate an alarm condition audibly as well as visibly and indicate the location of danger.
Deactivation	To bring a component into its inactive activation state (a component can have only one inactive activation state). Examples of deactivation are turning a fire extinguisher off and silencing a sounder.
Detection Loop	Loop circuit connecting a number of fire detectors, manual call-points and other Loop Units. A detector loop is connected to control and indicating equipment.
Detection Zone	One or more fire detectors and/or manual call-points logically belonging together for geographical, functional or other reasons.

Term / Abbreviation	Explanation
Disable(ment)	When you disable an *active* component, for example, a sounder issuing an alarm signal, the component will immediately switch to the OFF state without any user notification and/or confirmation cause. A disablement of a *deactivated* component, for example, a sounder not issuing an alarm signal, will have no immediate effect on system operation. Both activated and deactivated disabled components will remain switched off until enabled.
Domain Network	The domain network consists of a number of components, connected over AUTROLON.
Enable(ment)	Setting the arm state of a disabled *deactivated* component to ENABLED will have no immediate effect on system operation. The component will remain deactivated until its activation state is set to an active state (on alarm or on command).
Fault Warning Routing Equipment (FWRE)	Intermediate equipment which routes a fault warning signal from (B) to a fault warning signal receiving station.
Fire Alarm Device (FAD)	Equipment used to give warning of fire, for example, sounder or visual indicator.
Fire Alarm Recieving Station	A centre from which the necessary fire protection measures can be initiated at any time.
Fire Alarm Routing Equipment (FARE)	Intermediate equipment which routes an alarm signal from control and indicating equipment to a Fire Alarm Receiving Station.
Fire Detector	The part of an automatic fire detection system which constantly or at frequent intervals monitors suitable physical and/or chemical phenomena for detection of fires in the area under surveillance.
Fire Protection Equipment (FPE)	Fire control or fighting equipment, e.g. extinguishing installation.
Loop Unit	Either a Point, and I/O-unit or and Electronic Sounder that is connected to a Detection Loop.
Manual Call-Point	A device for the manual initiation of an alarm.
Operation Zone	An Operation Zone defines the scope of an Operator Panel. One operation zone may encompass one or more detection zones. Operation zones are allowed to be contained in other operation zones, building an hierarchy consisting of different levels of operation zones. Operation zones must be fully contained in each other, i.e. the operation zone can not be partly contained in (overlap) another operation zone. One operation zone may be controlled by more than one Operator Panel.
Point	Detectors or manual call-points. Each point is assigned zone membership on individual basis. A point can be a member of one detection zone only. A point may signal a number of different alarm levels. A manual call-point can only signal a Fire Alarm Level. To each point there will be assigned a delay parameter, notifying whether actions to be initiated upon reception of a Fire Alarm signal from the point should be delayed or not. The delay parameter is only valid in conjunction with Delayed Action or SOLAS.
SOLAS	A program version of the AutroSafe software, spesially designed for maritime application - Safety Of Life At Sea (SOLAS).
SVD	Self Verifying Detection

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